

A NEW LOWER MIOCENE SPECIES OF *ANODONTIA* (MOLLUSCA: BIVALVIA)

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Abstract. A new species, *Anodontia (Anodontia) waharoaensis*, is described from the Lower Miocene Waitakere Group, Motutara, West Auckland. It is the first record of the genus from New Zealand.

Numerous trips to the coastline of Motutara, between Otakimiro Point, Muriwai, and Raetahinga Point, Motutara, have yielded many varied and unusual macrofossils (Powell 1935, Hayward 1976a). A partial crystalline shell and incomplete internal cast of a large bivalve were collected by the author from Tirikohua Point on 22 June 1990. An expedition further south to Te Waharoa Bay on 23 and 24 May 1992, located several bedding planes with internal casts and a complete, crystallised, articulated specimen of the same mollusc in situ. Site locality numbers are those of the Geological Society of New Zealand's archival Fossil Record File.

GEOLOGICAL SETTING (Fig. 1)

The two fossil sites are located within the Waitakere Group, Manukau Subgroup, Tirikohua Formation (Hayward 1976b). They are: 1. Tirikohua Point Site, Q11/f45, Bartrum Member; and 2. Te Waharoa Bay Site, Q11/f52, Otakimiro Member. Both Bartrum and Otakimiro Members were deposited in a submarine canyon and consist of thick, massive, fine pebble-bearing volcanic grit or coarse sandstone containing lenses of cross-bedded volcanoclastic sandstone (Hayward 1976a). The stratigraphy of the Otakimiro Member, from which the holotype came, is shown in Fig. 1. For stratigraphy of the Bartrum Member see Hayward (1983).

SYSTEMATICS

Class	Bivalvia
Subclass	HETERODONTA Neumayr, 1884
Order	VENEROIDEA H. Adams & A. Adams, 1856
Superfamily	LUCINACEA Fleming, 1828
Family	LUCINIDAE Fleming, 1828
Subfamily	MILTHINAE Chavan, 1969
Genus	<i>Anodontia</i> Link, 1807
Subgenus	<i>Anodontia</i> Link, 1807
Type species :	<i>A. alba</i> (= <i>Venus edentula</i> , Linne, 1758; OD). Recent, Indian Ocean.

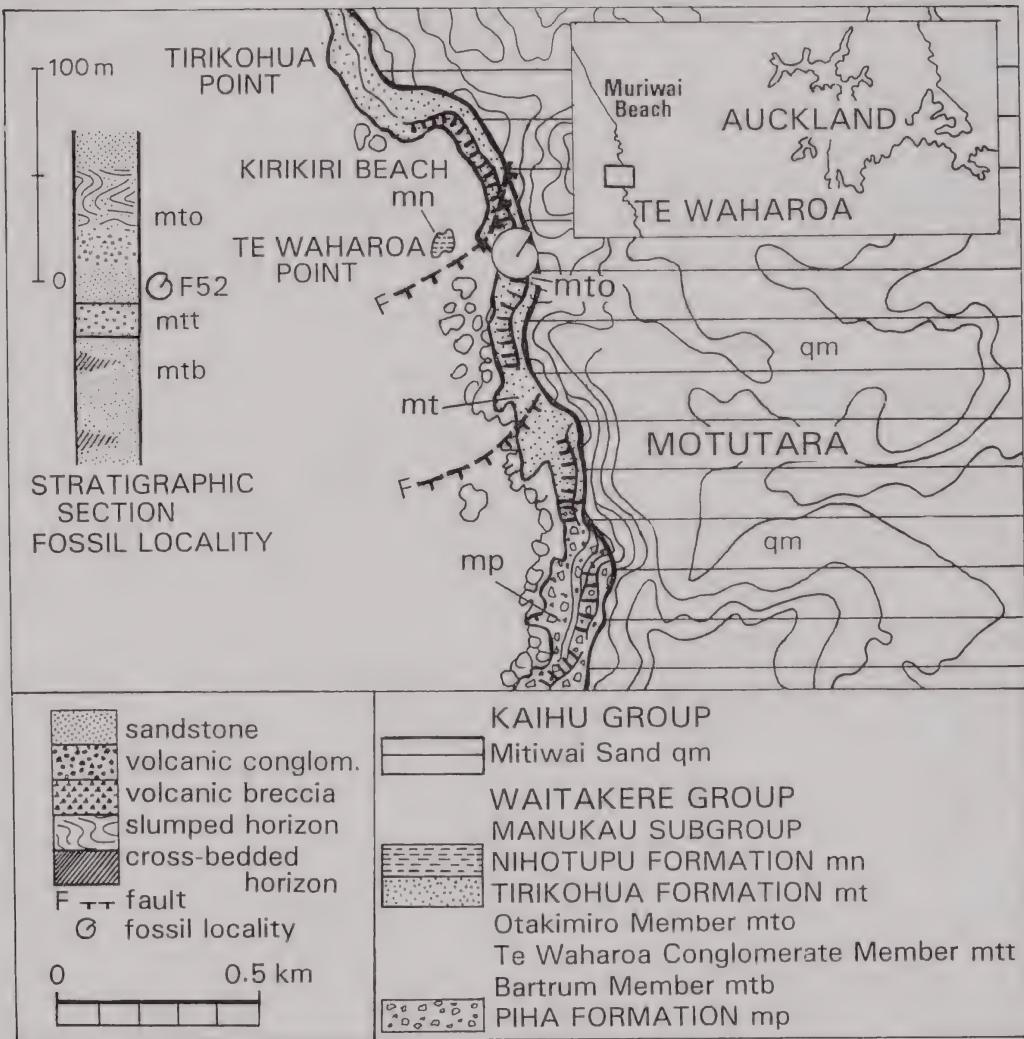


Fig. 1. Geological map of the northern part of Te Waharoa Bay within the area known as Motutara showing the fossil type locality and stratigraphic column for Te Waharoa Point (after Hayward 1983).

Anodontia (Anodontia) waharoaensis n. sp. (Figs. 1-6, 9, 10).

MATERIAL

Holotype. AK72308 (Auckland Institute and Museum), complete articulated crystalline bivalve, Q11/f52.

Paratypes. AK72309 (Auckland Institute and Museum), 6 internal casts or impressions, Q11/f52. ME9002 (author's collection) 1 internal cast, Q11/f52. L3862 (University of Auckland), 2 internal casts or impressions, Q11/f45.

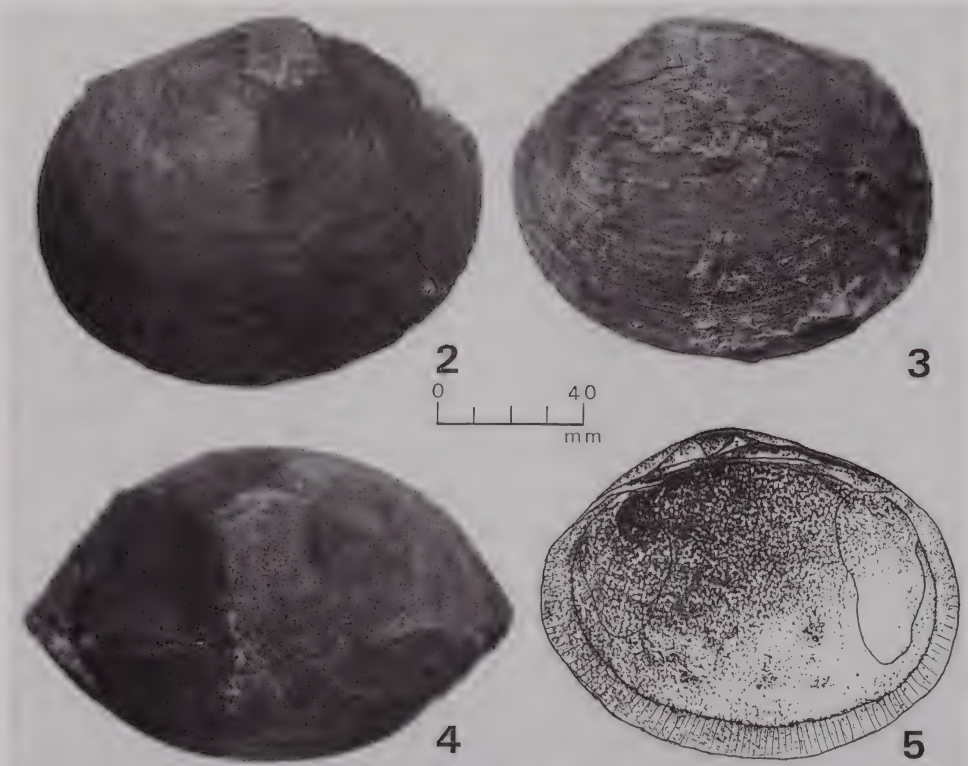
TYPE LOCALITY

Fossil record file number Q11/f52; grid reference Q11/382816 (NZMS 260 1:50 000 map), Te Waharoa Bay, Motutara, West Coast, Auckland.

DESCRIPTION

Shell very large, subcircular, slightly longer than high, strongly inflated and globose, subspherical, slightly truncate posteriorly; equivalve; beak slightly anterior of midline, thick and solid. Beak prosogyrous, low and inconspicuous. Shell surface has weak, irregular, comarginal grooves and low growth lamellae. A weakly defined shallow sulcus and low ridge continuing forward from below the beak define a narrow, slightly raised postero-dorsal area on which the comarginal lamellae are less consistently developed than elsewhere. Lunule tiny, deep.

Ligamental groove oblique, sunken, lanceolate, with inward sloping walls. The hingeline is gently curved; postero-ventral margin broadly rounded. Shell interior and internal casts prove lower, inner section of the anterior adductor muscle scar to be long, lying well above the pallial line and elongated vertically. Posterior adductor muscle scar trapezoidal, broader, situated at a similar distance above pallial line than anterior scar. Internal casts possess an entire pallial line; whole shell interior dimpled



Figs. 2-5. The holotype AK72308. 2. Right valve showing slightly truncate posterior shape and large size. 3. Left valve showing weak, irregular, comarginal grooves and low growth lamellae. 4. Conjoined valves of holotype in dorsal view showing prosogyrous beaks, weakly defined shallow sulcus and low ridge continuing forward from below the beaks. 5. Reconstructed internal right valve showing both anterior and posterior adductor muscle scars, a dimpled and rugose shell interior, and an entire pallial line.

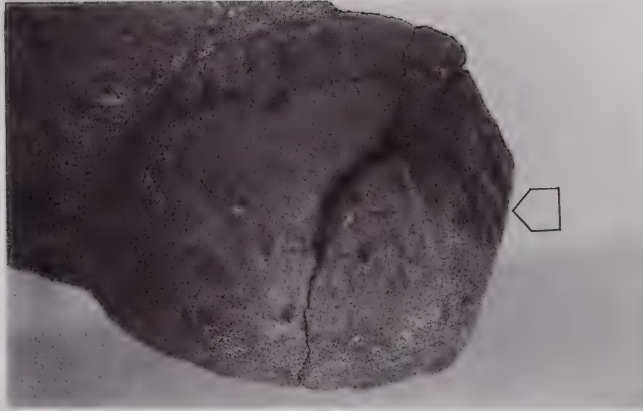
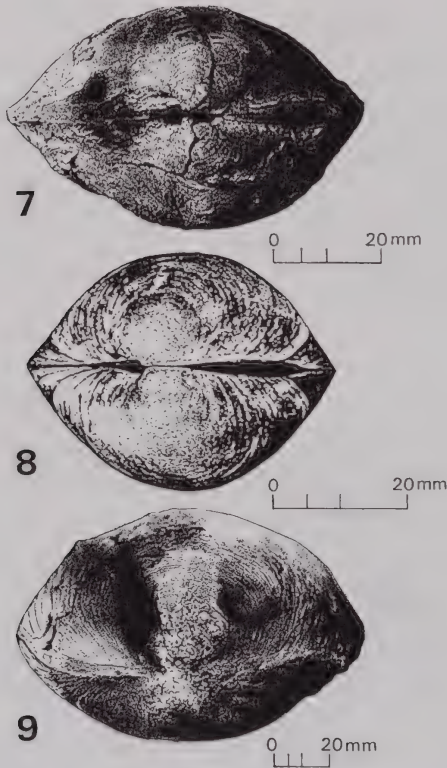


Fig. 6. Partial left valve steinkern of the paratype L3862b showing the long anterior adductor muscle scar elongated vertically well above the pallial line (arrowed), and the zone between the pallial line and the ventral margin covered in fine, irregular, radial lirae c.1 mm apart.



Figs. 7-9. Dorsal views of one Recent and two fossil species of *Anodontia* (*Anodontia*) comparing conjoined valves, beak configuration, and inflation. 7. *A. (A.) inflata* (Eocene). 8. *A. (A.) edentuloides* (Recent). 9. *A. (A.) waharoaensis* (Miocene).

and rugose; ventral margin entire; zone between pallial line and margin bearing fine irregular radial lirae 1 mm apart, stronger and more regular near margin.

Measurements of the holotype (AK72308) are: length 123 mm; height 123 mm; convexity 48 mm; postumbonal length 65 mm; anterior-dorsal apical inclination 25°. Because the paratypes are incomplete they cannot be measured accurately.

AGE

Middle-Altonian (Pl) (Burdigalian), early Miocene (Hayward 1983).

ETYMOLOGY

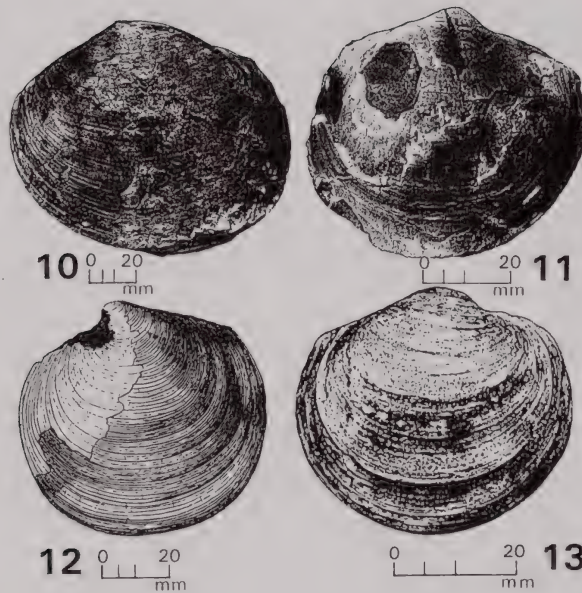
Named after the type locality, Te Waharoa Bay.

FAUNAL ASSOCIATIONS

Powell (1935) and Hayward (1976c) described a small but highly distinctive bathyal molluscan fauna from rocks north of the present fossil localities. Several taxa discovered there occur in situ with *A. (A.) waharoaensis* (Table 1). *Saccella* is an accepted outer shelf to upper bathyal genus, as is the gastropod *Bathytoma*, and their association with the genus *Amygdalum*, of which there are no recent records from the seas around New Zealand, confirms this paleodepth. *Amygdalum* now lives in tropical and warm temperate waters, byssally attached to a hard substrate mostly in outer shelf to bathyal depths (Beu et al. 1990), suggesting a similar environment in the mid-Altonian at Te Waharoa.

Table 1. Systematic list of fossil fauna found in association with *A. (A.) waharoaensis*. Nomenclature follows Beu et al. (1990).

	MOLLUSCA
	BIVALVIA
NUCULANIDAE	<i>Saccella motutarensis</i> (Powell, 1935)
MODIOLINAE	<i>Amygdalum dolichum</i> (Suter, 1917)
LIMIDAE	<i>Lima colorata</i> Hutton, 1873
LUCINIDAE	<i>Lucinoma taylori</i> (Powell, 1935)
TELLINIDAE	<i>Elliptotellina protensa</i> (Powell, 1935)
	GASTROPODA
ACMAEIDAE	<i>Pectinodonta conformis</i> (Marwick, 1931)
TURRITELLIDAE	<i>Zeacolpus</i> sp.
TURRIDAE	<i>Bathytoma michelsoni</i> Powell, 1935
CUVIERINIDAE	<i>Vaginella inflata</i> Hayward, 1981
	ANNELIDA
POLYCHAETA	<i>Protula</i> sp.



Figs. 10-13. Comparison of one Recent and three fossil species of *Anodontia* (*Anodontia*) showing differences in valve shape, antero-dorsal angle of apical inclination, and comarginal lamellae. 10. Holotype of *A. (A.) waharoaensis* (fossil). 11. Holotype of *A. (A.) inflata* (Kern County, Southern California - fossil). 12. Holotype of *A. (A.) sphericula* (Edithburg, South Australia - fossil). 13. *A. (A.) edentuloides* (Magdalena Bay, California - Recent).

DISCUSSION

This is the first record of the genus *Anodontia* (*Anodontia*) from New Zealand. Fleming (1950) described a new lucinid, *Loripinus arapaoa*, from the Pahi Greensands, Pahi Peninsula, North Auckland. This Eocene (Bortonian) mollusc was tentively allocated by Fleming to the subgenus *Eophysema* Stewart, because of its shape and fine radial sculpturing. Following Chavan's (1969) revision of the Lucinidae, it is clear that Fleming's species should now be referred to *Pegophysema* (*Eophysema*) *arapaoa* rather than *?Loripinus arapaoa* (Beu et al. 1990).

Fleming (1950: 245), mentions that "additional species [of lucinid] as yet undescribed, occur in the Miocene [of New Zealand] and reach over twice the size of the recent species". *Anodontia* (*Anodontia*) *waharoaensis* n.sp. is larger than both the three known recent species and the two fossil circum-Pacific species. It possess the greatest anterior dorsal apical inclination (25°) and is the most posterior-truncate in shape.

The Recent type species *Anodontia* (*Anodontia*) *alba* (Linne, 1792) is only half the size of the new species (length 51 mm, height 44 mm, convexity 31 mm), is more circular, and is not as inflated. It is similarly heavy and fairly strong, but with much weaker, irregular, concentric growth lines. The postero-dorsal area is not as raised. The anterior dorsal margin incorporating a reduced 'wing' is convex and not straight as in *A.(A.) waharoaensis*. Internal adductor muscle scars also differ in size and shape; the

posterior scar is proportionally smaller and more oval than the anterior scar which is longer and not as wide.

Anodontia (Anodontia) stearnsiana (Oyama et al., 1960), differs from the new species by being only half the shell size (length 62 mm, height 56 mm, convexity 39 mm). It has a more prominent beak apex, subalate anterior and posterior dorsal margins, and is more circular in shape. The posterior area is not as raised in *A. (A.) waharoaensis*, and the irregular comarginal growth lines are finer.

Anodontia (Anodontia) edentuloides (Verrill, 1870) is subglobose and convex, with a comparably thin shell (Figs. 8 & 13). It is approximately one third the size of the new species (length 45 mm, height 38 mm, convexity 27 mm). The irregular growth lines differ in being 'wrinkled', however they are set off by deep marks indicating growth resting stages, and are therefore 'banded'. Minute radial striae may also be seen. The pallial line differs from the new species in that it is covered with a punctated calcareous coating. The ligamental groove is shorter and of all the specimens compared, this species has the smallest anterior-dorsal apical inclination (17°). The adductor muscle scars are not as long or broad as in the new species.

Darragh (1970) allocated *Meretrix sphericula* Basedow, 1902 (Miocene, South Australia) to the genus *Anodontia*. *Anodontia (Anodontia) sphericula* (Fig. 12) is different from *A. (A.) waharoaensis* in being more circular, having a surface ornamentation of fine concentric threads between numerous, similar, coarse, and irregular growth lines. On denuded shell areas, faint radial striae are more numerous and prominent than those occasionally found on the new species. The lunule in *A. (A.) waharoaensis* is tiny and deep, whereas in *A. (A.) sphericula* it is prominent and lanceolate. The Australian fossil is approximately spherical (length 74 mm, height 67 mm, convexity 50 mm) and more regularly convex in appearance than the posteriorly truncate *A. (A.) waharoaensis*. As it is comprised of two conjoined valves, the interior of the *A. (A.) sphericula* specimen is unknown.

Moore (1988) tentatively allocated the poorly preserved Eocene *Phacoides (Callucina) inflata* (Fig. 7) from southern California to *Anodontia (Anodontia)* on the basis of the rounded shape and very globose valves (length 66 mm, height 61 mm, convexity 43 mm). Like *A. (A.) waharoaensis*, the remaining shell has no fine concentric ridges or lines, is subcircular and broadly truncate with the beak slightly anterior to centre. The specimen possesses a distinct, small, deeply impressed lunule, and a straight anterior dorsal margin (see Figs. 7 & 8). Both species are ribbed internally by faint, irregular radial ribbing, which crenulates the ventral edge in *A. (A.) inflata* but not in *A. (A.) waharoaensis*. The new species is more truncate posteriorly, possesses a more oblique, sunken, ligamental groove, is longer, higher, and more convex. The irregularly spaced incremental growth lines are fewer and are coarser than those of *A. (A.) inflata* (Figs. 10-13).

Anodontia (Anodontia) is found as a fossil in deep-water Eocene and younger rocks in Europe, Asia, North America, the Pacific Ocean and Australia. Living taxa are found in shallow, (15-100 m) mud-bottomed depths from North Carolina to Florida, in the Gulf of Mexico, in the West Indies and Bermuda, in Magdalena Bay in South

California, from Kyushu to Honshu and in the Amami O shima Islands in Japan. It appears therefore that this genus has changed its preferred bathymetric niche during the Neogene.

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